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JAPANESE [JP,2000-043243,  
A]

CLAIMS DETAILED DESCRIPTION  
TECHNICAL FIELD PRIOR ART  
EFFECT OF THE INVENTION  
TECHNICAL PROBLEM MEANS  
DESCRIPTION OF DRAWINGS  
DRAWINGS

[Translation done.]

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## DETAILED DESCRIPTION

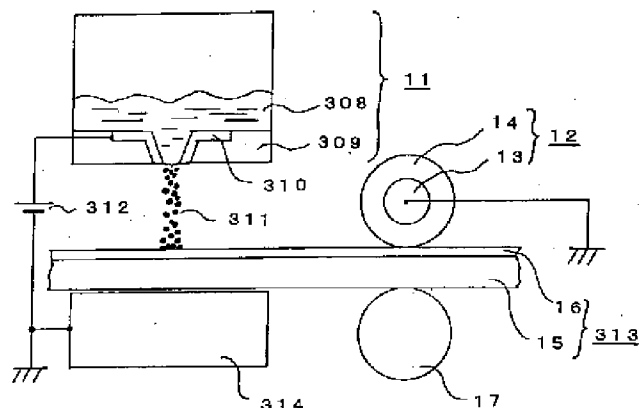
[Detailed Description of the Invention]  
[0001]

[Field of the Invention]This invention relates to the recorder which outputs a picture to a record paper, especially the recorder of an inkjet method.

[0002]

[Description of the Prior Art]Although there are various kinds of the ink discharge methods of the conventional ink-jet recording device, most is what records 1 dot by one drop of ink droplet, The method to which some dot diameters, i.e., volume of an ink droplet made to breathe out, can be changed is also impossible for still sufficient gray scale representation for every dot of a certain thing. In order that many particles of several microns or less in diameter ink mist may gather

Drawing selection Representative draw



11 記録ヘッド	12 アースローラ	15 ベース層	18 インク受容層
308 インク層	309 ノズル板	310 インク帯電電極	
311 インク粒	313 記録用紙	314 背面電極	

[Translation done.]

and the method which is in such inside, makes mist shape generate ink using an ultrasonic wave (regurgitation), and is printed may form 1 dot, there is the feature that beautiful gray scale representation can be performed for every dot. Such a method is indicated to JP,62-85948,A and shows this to drawing 5.

[0003]In drawing 5, 301 is an ultrasonic generating means and uses the PZT lamination actuator. 302 and 303 are focussing-of-ultrasonic-waves means, and use SUS304 as a raw material. It is a means by which 305 holds 304 in the source of an ultrasonic signal, and is held to a stationary plate, and 306 holds the front face of a tip of the ultrasonic energy means of communication 307 to the position in the ink layer 308, and sound rubber is used here. As the ultrasonic energy means of communication 307, what is called an ultrasonic wire (supersonic vibration needle) that consists of a small-gage wire using material with few sound losses is used. Using the alloy in which a raw material comprises aluminum, iron, chromium, nickel, and titanium, a wire gage must be comparable as a record pixel, or must be less than right. 308 is the ink layer in which the ink which should be breathed out accumulated. 309 is a nozzle plate which has an opening as a nozzle, and the nozzle diameter is comparable as the diameter of the supersonic vibration needle 307. In this example, the electrifying electrode 310 is formed in a nozzle 500 microns in diameter. The ink jet head as a recording head is formed with the nozzle plate 309 and the electrifying electrode 310.

[0004]314 is a back plate and the record paper 313 is held on it. Between the electrifying electrode 310 and the back plate 314, voltage (electrification voltage) is impressed by the electrification record power supply 312. The distance of the back plate 314 and the nozzle plate 309 is hundreds of microns, and electrification voltage is 1 kV - about 5 kV at this time. 315 is an insulating layer, separates electrically the focussing-of-ultrasonic-

waves means 302 and the ultrasonic generating means 301, and applies hundreds of microns thermoset epoxy resin. 316 is an image signal source. [0005] Next, operation and an operation are explained. The source 304 of an ultrasonic signal is controlled by the image signal source 316, and the ultrasonic generating means 301 is driven. The ultrasonic energy generated from the ultrasonic generating means 301 converges by the focussing-of-ultrasonic-waves means 302 and 303, is emitted by the supersonic vibration needle 307 into the ink layer 308, and generates the ink mist style 311. The phenomenon which mist generates from an oil level according to a focused ultrasonic wave is more generally than before known. At this time, the ink mist style 311 is charged in + from the high tension of + being impressed to the electrifying electrode 310. And it is accelerated by the electric field between the back plates 314, the record paper 313 is adsorbed, and printing is completed. Since the generating time of a mist style changes by changing time (pulse width) to drive the ultrasonic generating means 301, it is possible to also change the concentration of the print dot recorded.

[0006]

[Problem(s) to be Solved by the Invention] The conventional ink-jet recording device, especially the ink-jet recording device of the type which electrifies ink mist by a mist method are constituted as mentioned above, and special consideration which is suitable for this method was not made by the record paper. In the case of ink jet recording, when thinking image quality as important, generally coat paper is used, but if this is used for the ink jet of the type printed by the electrified ink mist, since electrical resistance is large, the electric charge of ink mist cannot escape easily. For this reason, high printing of record density was performed, namely, when it was going to make much ink mist adhere to the same field in piles, the ink mist electrified to like-pole nature opposed and suited, and the tendency

which spreads horizontally was suited. That is, there was a problem that definition deteriorated, such as becoming thick even if it is going to print a small-gage wire.

[0007]p.162 of "imaging part2" of Photograph Industrial Publishing company issue has the description about the conventional record paper for ink jets. In this, the degree of size, air permeability, smoothness, voidage, a whiteness degree, etc. are taken up as physical properties of paper, and that to which articles other than this have also mentioned resistivity with the ink jet recording sheet is not found. First of all, it is because the concept of missing an electric charge since the ink droplet which flies is not charged etc. did not exist in the general conventional ink jet recording.

[0008]This invention was made in order to cancel the above problems, and an object [ lap upwards, without electrified ink opposing, / can print, namely, ] of an invention is to obtain the good ink-jet recording device of definition at high concentration.

[0009]

[Means for Solving the Problem]An ink-jet recording device concerning this invention, In an ink-jet recording device which impresses voltage between a recording head and a back plate provided in the back of a record paper, electrifies an ink grain, makes an electrification ink grain attract with said back plate, and records on a record paper, An electrification charge elimination means which removes electrification charge of an ink grain adhering to said record paper is established.

[0010]As said electrification charge elimination means misses an electric charge of \*\*\*\*\* and an electrification ink grain for electric conduction processing through a record paper in said record paper, said record paper serves as said electrification charge elimination means.

[0011]Said record paper has an ink absorbing layer containing an electric conduction processing agent.

[0012]Below  $10^9 \Omega \text{cm}$  carries out volume resistivity of a paper as said

record paper.

[0013]An electrifying means which electrifies said record paper in polarity with the opposite electrification load polarity of said ink grain before printing to said record paper constitutes said electrification charge elimination means from an ink-jet recording device concerning this invention.

[0014]A conductive roller is used as said electrifying means.

[0015]

[Embodiment of the Invention]an embodiment of the invention -- below 1. describes this embodiment of the invention 1 about a figure. In drawing 1, although 11 is an ink jet head of the mist method as a recording head and the composition is almost the same as that of the thing of drawing 5 described by the conventional example, by drawing 1, near a nozzle is indicated and the structure of the portion where an ultrasonic wave is generated and transmitted is omitted. 12 is an earth roller for missing the electric charge of the electrified ink mist 311, and the conductive rubber 14 is twisted around the surroundings of the metallic rodding 13. The rodding 13 is grounded. The record paper 313 consists of the base layer 15 of a paper raw material, and the conductive ink absorbing layer 16 by which coating was carried out on it. Plastic films, such as PET (polyethylene terephthalate), may be sufficient as the base layer 15 besides paper. The conductive ink absorbing layer 16 contains electric conduction processing agents, such as hydrophilic inorganic substance particles, such as porous silica for raising the receptiveness of ink and attaining high definition-ization, and sodium chloride for raising conductivity. The conductive ink absorbing layer 16 of the record paper 313 contacts the earth roller 12 with the auxiliary roller 17. 314 is a back plate and the voltage of 500V is impressed by the electrification power supply 312 between this and the electrifying electrode 310 in the ink jet head 11. The distance of the surface of

the nozzle plate 309 and the surface of the record paper 313 was 1 mm. 308 is ink and uses the water-based ink of resistivity abbreviation  $2 \times 10^2 \Omega \text{cm}$ .

[0016]Next, operation and an operation are explained. When printing, the ultrasonic generating means which is not illustrated is driven, and ink mist is made to breathe out from the ink jet head 11 (from the opening of the nozzle plate 309). Although the position of ink discharge differs from drawing 5 for a while, the fundamental mist generating principle is almost the same as a conventional example. The electrifying electrode 310 is in contact with the ink 308, and since the resistivity of ink is also as low as  $2 \times 10^2 \Omega \text{cm}$ , as for the ink 308, many + electric charges exist in the surface which the whole serves as the electrification power supply 312 and same electric potential which are 500V, and counters the back plate 314. At this time, since it dissociates compulsorily as mist grain, + electric charge will be in ink mist (charged in +). This ink mist 311 flies toward the record paper 313, being accelerated by the electric field between the back plate 314 and the electrifying electrode 310, and adheres on the conductive receiving layer 16. Here, + electric charge of ink mist reaches the earth roller 12 through the conductive receiving layer 16 with low electrical resistance, and is emitted to a ground from there. That is, the ink mist which arrived on the record paper 313 can emit an electric charge immediately, and does not repel the ink mist electrified in + which flies from the next to the next. Therefore, since ink mist cannot spread to a transverse direction but can make it adhere to an infinitesimal area in piles, it is effective in the ability to perform printing with dramatically sufficient definition.

[0017]Although the electric charge of electrification mist was missed to field inboard through the conductive receiving layer 16 in this embodiment, if there is conductivity also in the base layer 15, it is also possible to miss an

electric charge to a thickness direction. This point is described below.

[0018] Similarly embodiment-of-the-invention 2., next this embodiment of the invention 2 are described using drawing 1. It is not necessary to use the earth roller 12 in particular in this embodiment. Although the conductive receiving layer 16 is the same ingredient as Embodiment 1, its resistivity may be higher than Embodiment 1. The base layer 15 has given conductivity by mixing paper pulp and a metal fiber, and, below in  $10^9 \Omega \text{cm}$ , volume resistivity has become in record paper 313 total.

[0019] On the occasion of printing operation, the ink mist 311 charged in + as Embodiment 1 described adheres to the record paper 313. In this embodiment, since the record paper 313 whole has conductivity, it escapes [ be / it / under / record paper 313 / passing ] from + electric charge on ink mist to a thickness direction, and it is emitted to a ground from the back plate 314. As a result, since ink mist cannot spread to a transverse direction but can make it adhere to an infinitesimal area in piles, it is effective in the ability to perform printing with dramatically sufficient definition.

[0020] Here, explanation theoretical about required resistivity is given. The electrical equivalent circuit of the record paper 313 can be assumed to be R (resistance) and C (capacity) parallel connection as shown in drawing 2. At this time, the damping time constant tau which surface potential decreases is  $\tau = RC$ . .... (1)

It becomes. R and C are  $R = \rho d / S$ , respectively.... (2)

$C = \epsilon_0 \epsilon_r S / d$  .... (3)

It is expressed. Here, it is the volume resistivity [ $\Omega \text{cm}$ ] of rho: record paper.

d: Thickness [m] of a record paper

S: Area on the assumed record paper [ $\text{m}^2$ ]

$\epsilon_0$ : Dielectric-constant-of-

vacuum  $= 8.85 \times 10^{-12} [\text{C}^2 \text{N}^{-1} \text{m}^{-2}]$

the specific inductive capacity of an

$\epsilon_r$ :record paper --

$$\tau = \epsilon_0 \epsilon_r \rho \dots (4)$$

It becomes. In the case of paper or a plastic film, the specific inductive capacity of a record paper is about three to about seven, and is set to  $\epsilon_r=3$  here. When time which record of 1 dot takes is set to 500 microseconds (dot frequency of 2 kHz), if it assumes that below the half is required for a damping time constant, it will have been  $\tau < 250$  microseconds at least. At this time, it is  $\rho = \tau / (\epsilon_0 \epsilon_r) < 250 \times 10^{-6} /$

$$(8.85 \times 10^{-12} \times 3) = 9.4 \times 10^{-6} [\text{ohm} \cdot \text{cm}].$$

$$= 10^{-7} [\text{ohm} \cdot \text{cm}]$$

= It is set to  $10^{-9}$  [ohm·cm] (5).

Therefore, below  $10^{-9}$  [ohm·cm] of volume resistivity is desirable.

[0021] Here, although the above-mentioned Embodiment 2 showed the case of the two-layer structure where a record paper has a coating layer, it may consist of homogeneous material which does not have a coating layer, for example. Although volume resistivity is generally a value of the material itself and the case of being homogeneous is considered, a definition here is carried out to calling volume resistivity a value of  $\rho$  with which the electrical resistance  $R$  of the thickness direction in the area which the record paper assumed is satisfied of (2) types, even when the electrical resistance of a record paper has anisotropy.

[0022] Electrical resistance receives the influence by humidity and serves as such a high value that humidity generally becomes low. Therefore, it is necessary to satisfy the aforementioned value at operation of a product or 20% of the minimum humidity of a use coverage, for example, relative humidity.

[0023] an embodiment of the invention -- below 3. describes this embodiment of the invention 3 about a figure. In drawing 3, 23 is an electrifying means and uses the corona-electrical-charging machine here. 21 is a metallic chassis, 22 is a tungsten wire 80 microns in



diameter, and the common corona-electrical-charging machine 23 is constituted. Here, scorotron etc. may be sufficient although corotron is used as a kind of corona-electrical-charging machine. 24 is a power supply for corona-electrical-charging machines. 25 is a - (minus) electric charge which occurs from a corona-electrical-charging machine and exists on the record paper 313. 26 is a paper conveyance roller of the couple for record paper 313 conveyance. Although 313 is a common ink jet dedicated paper and coating of the ink absorbing layer 16 is carried out, there is no conductivity which was described by said embodiment here. Other portions are the same as that of Embodiment 1, identical codes are given to the same part and explanation is omitted.

[0024]Next, an operation of operation is explained. Printing is performed while the record paper 313 is conveyed in the direction of figure Nakaya seal A by the paper transportation roller 26. If the record paper 313 comes to the position of the corona-electrical-charging machine 23, the corona-electrical-charging dexterous power supply 24 will serve as one, and 22-5 kV of tungsten wires will be impressed. As a result, it is generated by - ion and the surface of the record paper 313 is electrified in -. Surface potential is abbreviation-700 - -800V. It is good for the position which the direction of scorotron is suitable in order to electrify homogeneity more, and counters with the corona-electrical-charging machine 23 on both sides of the record paper 313 to provide a ground electrode. Here, since the record paper 313 has large electrical resistance, the - electric charge 25 is held and arrives at a print position by paper conveyance. If a recording head drives at this time, the ink mist 311 electrified like the above-mentioned embodiment in + will occur. When the ink mist 311 reaches on the record paper 313, it is neutralized in contact with the - electric charge 25. Therefore, since ink mist cannot spread to a transverse direction but can

make it adhere to an infinitesimal area in piles, it is effective in the ability to perform printing with dramatically sufficient definition.

[0025] Since electrification with the corona-electrical-charging machine 23 is performed all over the printable range of a record paper, in the part which was not printed, - electric charge will remain. For this reason, it is better to form the means which discharges electricity after printing.

[0026] There are no restrictions in particular as the record paper 313. However, as for an effect, though natural, what has high resistivity is larger. It is because it is not necessary to make it come especially using a corona-electrical-charging machine if resistivity is low to be charged in order for an electric charge to escape easily like the above-mentioned Embodiments 1 thru/or 2.

[0027] an embodiment of the invention -- below 4. describes this embodiment of the invention 4 about a figure. In drawing 4, 31 is a conductive roller of the couple which consists of the conductive rubber 14 planted on the rodding 13 and the surroundings of it, and serves also as the roller for conveyance of a paper. The thing in the side which touches the ink absorbing layer 16 of a record paper among the conductive rollers 31 of a couple is connected to -1 kV of 32 power supply, and another side is connected to the ground. Other portions are the same as that of Embodiment 3, identical codes are given to the same part and explanation is omitted.

[0028] And 31-1 kV of conductive rollers are impressed. [ in the case of printing ] [ the power supply 32 of a conductive roller ] As a result, the surface of the record paper 313 in contact with the conductive roller 31 is charged in abbreviation-700 - -800V. The record paper 313 is conveyed in the direction of figure Nakaya seal A by rotating the conductive roller 31 simultaneously. Since it can be neutralized by this surface charge 25, and ink mist cannot spread to a transverse direction as a result but the electrification mist 311 generated by

driving the recording head 11 can be made to adhere to an infinitesimal area in piles, it is effective in the ability to perform printing with dramatically sufficient definition.

[0029] Since the contact electrifying system with a roller is used in this embodiment, compared with the case where a corona-electrical-charging machine etc. are used, comparable electrification can be produced also in low electrification power supply voltage. For this reason, since it becomes the electrification power supply 312 for recording heads with the power supply voltage of the level mostly, common use of the electrification power supply 32 for rollers and the electrification power supply 312 for recording heads can also be carried out, and it is effective in part mark being reducible in this case.

[0030] In this embodiment, since the conductive roller 31 is used also for paper conveyance, it is not necessary to form the roller for paper conveyance independently, and is effective in the ability to perform reduction of part mark.

[0031]

[Effect of the Invention] As mentioned above, according to this invention, impress voltage between a recording head and the back plate provided in the back of the record paper, and an ink grain is electrified. In the ink-jet recording device which makes an electrification ink grain attract with said back plate, and records on a record paper, the electrification charge elimination means which removes the electrification charge of an ink grain adhering to said record paper is established. Electric conduction processing is performed to said record paper, and said record paper serves as said electrification charge elimination means. Said record paper has an ink absorbing layer containing an electric conduction processing agent. Below 10<sup>-9</sup>Ωcm carries out volume resistivity of a paper as said record paper.

[0032] The electrifying means which electrifies said record paper in polarity

opposite to the electrification load polarity of said ink grain before printing to said record paper is established as said electrification charge elimination means. It is effective in the ability of this invention to perform good printing of definition by these. Since the conductive roller was used as said electrifying means according to this invention, while it is effective in the ability to perform good printing of definition, it is effective in part mark being reducible.

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[Translation done.]